EFFECTS OF IMMEDIATE AND DELAYED FEEDBACK MODES OF ASSESSMENT ON STUDENTS' ACHIEVEMENT AND RETENTION IN CHEMISTRY

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Abstract
The purpose of the study was to ascertain the effect of immediate and delayed feedback modes of assessments on students' Achievement in Chemistry. Four research questions and four null hypotheses guided the study. Pretest-posttest non-equivalent control group quasi-experimental research design was adopted for the study. The population for the study comprised of 2,296 senior secondary class two (SS II) students offering chemistry in 21 co- educational secondary schools of Enugu Education Zone in Enugu State. A sample of 144 SSII students drawn from 3 public secondary schools in the zone was used for the study. A purposive sampling method and simple random sampling techniques were employed in the study. The instrument for data collection was chemistry achievement test (CAT) which consisted 40 test items. The instrument was validated by three experts; one expert in Measurement and Evaluation and the other two in Science Education. The reliability of was determined using Kuder-Richardson's formula-20 (K-R20) and the reliability coefficient obtain was 0.82. The instrument was administered as pretest and posttest. Mean and standard deviation were used to answer the research questions while the Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The Statistical Package for Social Science (SPSS) was used for all the analyses. The result of the analysis revealed that students who received immediate and delayed feedback modes of assessments achieved better than students who did not receive feedback. It was also revealed that students who received delayed feedback had higher achievement scores than students who received immediate feedback. Moreover the result showed that gender had no significant effect on students who received immediate feedback. The study recommended that chemistry teachers should ensure that students are given delayed feedback to enhance their achievement in chemistry.

Keywords: *Chemistry, Achievement, Immediate, Delayed and Feedback*

Introduction

Chemistry is one of the basic sciences needed for a nation's technological breakthrough. Chemistry is a branch of science which deals with the study of the structure, composition, properties and reactions of matter in different forms (Omeke, 2012). Ameh (2014), noted that chemistry is pre-occupied with the molecular transformation and manifestation of

matter, implying that Chemistry is involved in industrial production of fertilizer, soap, petroleum, drugs, beverages, recycling of waste materials, and the improvement of the quality of life of the citizenry. It therefore follows that a sound theoretical and practical knowledge of Chemistry is a pre-requisite for technological advancements in Nigeria. Despite the importance of Chemistry, it has not succeeded in producing the objective of Chemistry teaching in Senior Secondary School as stipulated in Senior Secondary School Chemistry Curriculum. The objective of senior secondary school Chemistry Curriculum is to enable students to; develop interest in the subject of chemistry, acquire basic theoretical and practical knowledge and skills, provide students with basic knowledge in chemical concepts and principles through efficient selection of contents and sequencing. acquire basic STM knowledge and skills, apply skill to meet societal needs of creating employment and wealth, show chemistry and its inter-relationship with other subjects, show chemistry and its links with industry, everyday life activities and hazards (FME, Senior Secondary Education Chemistry Curriculum, 2013)

None achievement of the objectives of chemistry teaching in senior secondary school, is evident in the form of poor students' achievement in Senior Secondary School Chemistry examination. For instance, research reports by Udoka (2020), and Agbo (2021), indicated students' low performance in Chemistry. Also, in the Chief Examiners report of 2017, 2018, 2019, 2020 and 2021 respectively attest to the evidence of poor achievement in school Chemistry. According to these researchers, in 2017 for the WAEC Examination, the percentage of Secondary School Chemistry students who had between A_1-C_6 was 36.55% while 63.45% had between D_7-F_9. In 2018, 34.50% had between A_1-C_6 while 65.50% had between D_7-F_9. In 2019 36.91% had between A_1-C_6 while 64.09% had between D_7-F_9. In 2020, 34.52% had between A_1-C_6 while 65.48% had between D_7-F_9. In 2021, 33.55% has between A1 – C6 while 66.45% had between D7 – F9.

In 2014, NECO Examination results, the percentage of secondary school Chemistry students who had between A_1-C_6 was 39.92% while 60.08% of students had between D_7-F_9. In 2015, 15.56% had between A_1-C_6 while 84.44% between had D_7-F_9. In 2016, 23.00% had between A_1-C_6 while 77% had between D_7-F_9. In 2017, 31.00% had between A_1-C_6 while 69.00% had between D7-F9. In 2018, 25.09% had between A_1-C_6 while 74.01% had between D_7-F_9 (NECO Chief Examiners Report, 2014, 2015, 2016, 2017, 2018). These statistics is alarming as students' performance continue to decline year after year. The poor performance tends to suggest that chemistry education in Nigeria is largely unsatisfactory.

Educators and parents have expressed their great concern over the poor performance of students in Chemistry. There have also been discussions and researches on who takes responsibility for the poor performance in Chemistry. Some parents tend to accuse the teacher and indeed the school for the poor performance of the students in Chemistry. Some teachers on the other hand tend to return the blame to the parents arguing that children stay more with their parents than with the teachers. However, the fact still remains that the problem associated with Chemistry teaching and learning is an

indication that some factors in the learning situation tends to inhibit students from performing as expected in the subject. Considerable research studies are being expended on how to improve students' achievement in Chemistry. A report by Ezeudu (2012), suggested that a re-orientation in the teaching, learning and evaluation procedure for better result is appropriate. Ezeudu emphasized the need to seek out innovative method of teaching and evaluation of the subject. Similarly, Agbo (2018), observed that there is a need for a change from the current method of evaluation, if students' achievement in Chemistry must improve.

Feedback is defined as the response which completes the cycle of communication from the source to the receiver and back to the source (Sinha, 2012). Feedback, once it is provided, makes the students concerned to begin to have better understanding of his/her capabilities and develop capacity to monitor, evaluate and regulate their own learning (Lemley, 2017). Stephene (2019), opined that feedback can motivate students and provide information they can use to improve or correct their learning. It also provides the teacher the opportunity to improve on the quality of imparted knowledge. The interaction students have through feedback influence them to understand how to develop their own learning. The essence of using feedback during the instructional process is to guide, direct and monitor students learning and progress towards achievement of course objective (Ajogbeje, 2012, & Afemikhe, 2015). In order words, the main objective of feedback according to Nizol (2010), are to; (i) justify to students how their marks or grade were desired (ii) identify and reward specific qualities in students work (iii) guide students on what steps to take to improve and (iv)motivate them to act on their assessment.

The use of feedback, in a classroom can be as simple as writing a few notes on students' essay, Chemistry homework, quiz, correcting a paper among others. Classroom activities such as writing or telling students how to find the right answer to a question allows them to understand the concept better, and know why they got it wrong and how they can correct it (Norlin, 2014). Quinn, (2014), is of the view that feedback provided as soon as the learner replies to a question or completes an assignment promotes retention of learned information. Feedback is most productive to a students' learning when they are provided with an explanation and examples as to what is accurate and inaccurate about their work. Studies have shown that when feedback is predominately negative, it can discourage students' effort and leads to lower achievement (Reyes, 2013). In order words, a teacher has a distinct responsibility to provide feedback in such a manner that the student does not leave the classroom feeling defeated. In addition, Ezekwesili and Ngonebu, (2015), posited that immediate and delayed feedback imparts students' progress or lack of progress in school subject more easily than other forms of feedback.

Immediate feedback is defined as scores for homework, quizzes and tests which are given to students and which serves as the guidelines they need to adjust their own learning and provides information to the correctness or incorrectness of their response immediately after a formative test (Sinha, 2012). Gaknep (2011) noted that immediate

feedback aids learning as behaviour is observable and still fresh in memory and thus promotes retention of learned information. When feedback is given immediately, after showing proof of learning, the student responds positively and remembers the experience about what is being learnt in a confident manner (Sinha, 2012). In order words, if the time taken is too long to give feedback, the memory might be lost and the student might not connect the feedback with action. Immediate feedback is therefore assumed an imperative assessment procedure in teaching and learning, however, its effect on students' achievement and retention in chemistry is not yet known. This created the gap for the study.

Delayed feedback on the other hand refers to the provision of information feedback four or five days after a test has been taken. It is a corrective measure that is provided not as soon as the learning experience is initiated (Lemley, 2017). Opitz (2011) asserted that delayed feedback occurs when there is a period of time between skill execution and feedback. Delayed feedback contrast with immediate feedback in that immediate feedback occurs immediately on the spot. Tori (2015) suggested that delayed feedback encourages learners to anticipate the answer, which may increase their level of attention to it when they receive it. The decision whether to correct immediately or later depends on various factors which include aims, class dynamics, learners attitude and expectation, motivation level or whether a mistake or an error has been made. One major advantage of delayed feedback as stipulated by Reyes (2013) is that students' response lack perspective. For instance, students might not understand the basis of some subject matter choices made by the teacher until much later or after the next assignment. Delayed feedback is assumed to arouse students' curiosity to learning and assessment. However, its effects on students' achievement and retention in chemistry is a gap yearning for urgent attention and this formed the concern of this study.

Achievement refers to the degree of success attained in some general or specified area (Chianson, 2011). Academic achievement in the context of this study can be defined as the quality of result produced by students as reflected in the quality of students' examination scores (Musa, 2015). It is a yard stick for measuring learning. It therefore follows that poor academic achievement indicates no, little or insufficient learning (Ameh, 2014). In order words, it is only what is learnt that is expressed as academic achievement.

Despite the general agreement among education stakeholders (Odoh, 2012, & Muhammad, 2019),that feedback plays important roles on students' achievement and retention, many studies are being conducted to address the impact of immediate versus delayed feedback on achievement and retention in other subjects and discipline. For instance the result of the study conducted by Yekta and Dafeian (2016), on effect of immediate or delayed feedback on vocabulary knowledge in English indicated that teachers' delayed feedback was significantly more successful than immediate feedback. This is in consonance with the study of Metcalfe, Kornell, and Finn, (2013), which indicated that delayed feedback was significantly more successful than immediate

feedback after investigating students' memory performance in English. The above findings were contradicted by the result of Kheradmand and Sayadiyan (2016), which indicated that students achieved more with immediate feedback than delayed feedback in writing accuracy in English. This corresponds with the findings of Aglah, Zotorvie, Tsrah and Akpastu (2014), who revealed that students perform better with immediate feedback than with delayed feedback in mathematics. Findings from Ezekwesili and Ngonebu (2015), revealed that students who receive delayed feedback performed better than those who receive immediate feedback in English Language. These findings disagreed with the findings of Ajogbeje (2012), which discovered that students who received immediate feedback performed better than those with delayed feedback in Mathematics. Being that the secondary school students are the targeted population for this study, it is worthy to note that the secondary school students under study are made of both male and female, thus, the use of delayed and immediate feedbacks and its effect on students' achievement and retention is dependent on some variables such as gender of secondary school students.

Gender is described as the biological sex of an individual in terms of being male or female. It has to do with socially expected behaviours of male and females. In Nigerian society, there are differences and inequalities in the assignment of responsibilities between women and men, activities taken, access to and control over resources as well as possession of some qualities (Adigwe, 2014). The influence of gender on students' achievement and retention have for a long time been of serious concern of many researchers and scholars. This is because no consistent result has been established on the effect of gender on the students' achievement and retention in chemistry. Ameh (2014), found that students' gender influenced their academic achievement and retention in chemistry. The above study differed from the study of Omeke (2012), who posited that there was no significant difference in academic achievement of male and female students in chemistry. This was contradicted by Apper (2016), who asserted that female students achieved and retained more in chemistry than their male counterparts. In the opinion of Ogbonna (2010), gender has no effect on student's achievement in chemistry. These contradictory findings are what necessitated the present study to find out the influence of gender on students' achievement in chemistry when they received immediate and delayed feedback.

The above background indicated that there is no consensus on the type of feedback that increases the achievement of students in subjects despite the benefits of immediate and delayed feedback. The researcher is not aware of any study that has explored the effect of immediate versus delayed feedback on students' achievement in chemistry in Enugu Education Zone of Enugu State. Therefore, there is need to find out which of the two types of feedback that increases students' achievement in chemistry. It is against this backdrop that the present study is aimed at determining the effect of immediate and delayed feedback on students' achievement in Chemistry in secondary schools in Enugu Education Zone of Enugu State.

Statement of the Problem

Despite the relative importance of Chemistry in improving the quality of life of the citizenry, students' performances in the subject in both internal and external examination have remained consistently poor. Chemistry educators are trying to identify the major problems associated with the teaching and learning of Chemistry in the secondary schools in Nigeria. Research findings has shown that poor students' achievement and retention in Chemistry can be traced to ineffective mode of assessment which can cause poor achievement and retention. An effective evaluation should result in improving students' learning through constant feedback. It is also known that one of the behaviours exhibited by students is the eagerness to get information regarding their performance in tests and assessment. However, results of number of studies revealed that teacher's feedback was related to students' greater achievement, but very little is known as to the effect of immediate and delayed feedback in evaluating students' achievement in chemistry. Being that no researcher ever investigated the effect of immediate and delayed feedback on students' achievement in chemistry in Enugu Education Zone, to the best knowledge of the researcher. Thus, the researcher is motivated to investigate the effect of immediate and delayed feedback on students' achievement in chemistry in Enugu Education Zone of Enugu State.

Purpose of the Study

The purpose of this study is to determine the effect of immediate and delayed feedback on students' achievement in Chemistry in Secondary Schools in Enugu Education Zone. Specifically, the study sought to;

1. determine the mean achievement scores of students who received immediate feedback and those who did not receive feedback in chemistry.
2. ascertain the mean achievement scores of students who received delayed feedback and those who did not receive feedback in chemistry.
3. compare the mean achievement scores of students who received immediate feedback and those who received delayed feedback in chemistry.
4. examine the mean achievement scores of male and female students who received immediate feedback and those who received delayed feedback in chemistry.

Research Questions

The following research questions will guide the study.

1. What is the mean achievement score of students who received immediate feedback and those who did not receive feedback in chemistry?
2. What is the mean achievement score of students who received delayed feedback and those who did not receive feedback in chemistry?
3. What is the mean achievement score of students who received immediate feedback and those who received delayed feedback in chemistry?

4. What is the mean achievement score of male and female students who received immediate feedback and those who received delayed feedback in chemistry?

Hypotheses

The following null hypotheses were raised and tested at .05 level of significance.

1. There is no significant difference in the mean achievement scores of students who received immediate feedback and those who did not receive feedback in chemistry.
2. There is no significant difference in the mean achievement scores of students who received delayed feedback and those who did not receive feedback in chemistry.
3. There is no significant difference in the mean achievement scores of students who received immediate feedback and those who received delayed feedback in chemistry.
4. There is no significant difference in the mean achievement scores of male and female students who received immediate feedback and those who received delayed feedback in chemistry.

Method

The research design adopted for the study is quasi-experimental design. Specifically, the design employed is a pre-test, post-test, non-equivalent, control group design. The design was chosen because the subjects for the study were not manipulated or randomized. Intact classes were used and the classes were randomly assigned to experimental and control groups. Ameh (2014), noted that, quasi-experimental design is a school friendly type of design in that it can be used in schools without any major disruption in school structure or timetable of academic events. The choice for quasi-experimental design was dictated by the fact that it is useful to identification of case-and-effect in any given study. Thus the researcher employed quasi-experimental design to identify the effect of immediate and delayed feedback on students' achievements in chemistry. The population for the study was made up of Two thousand, two hundred and ninety six (2296) senior secondary class two (SS II) students who were offering chemistry in the 21 co-educational public secondary schools in Enugu Education Zone (PPSMB, 2022).The 21 co-educational public secondary schools in Enugu Education Zone comprised; 4 secondary schools in Enugu East L.G.A, 5 secondary schools in Enugu North Local Government Area. and 12 secondary schools in Isi-Uzo. The choice of SS II students was based on the fact that the topic "chemical equilibrium" is in the chemistry syllabus for SSII students and also they are not in examination class to avoid distracting them from preparing for the external examination. The sample for the study is one hundred and forty four (144) senior secondary class two chemistry students' (81 males and 63 females). Purposive sampling technique was adopted to draw three co-Educational schools from the 21 secondary schools identified to have large students' enrolment. One school each was sampled from each of the three LGAs (Enugu North,

Enugu East and Isi-Uzo) in the zone. A further simple random sampling technique was employed to select one (1) intact class from each of the three sampled schools. Simple random technique was employed because it gave all the intact classes in each of the sample schools equal chance of being selected. The three intact classes selected were assigned to the three groups (two treatment groups and one control group) using the same simple random techniques. The treatment groups received immediate feedback (50 students) and delayed feedback (48 students) while the control group did not receive any feedback (46 students). The instrument for data collection is Chemistry Achievement Test (CAT) on Chemical Equilibrium. The CAT is a 40-item test package, developed by the researcher from the content area of the study. The CAT contained two sections: Section A, covered the students' personal data while section B comprised of 40 multiple choice questions, with four (4) options lettered (A-D) for each question. Questions were used from the contents of the lesson on chemical equilibrium.

The instrument was validated by three experts, two in Science Education Department and one in Mathematics and Computer Education Department, all from the Faculty of Education, Enugu State University of Science and Technology (ESUT), Enugu. The instrument was validated in terms of clarity of instructions, proper wording of items, appropriateness and adequacy of the items in addressing the purpose and problem of the study. The critical appraisals and comments of those experts were used for modifying the items to ensure that it measured what it was designed to measure. The reliability of CAT was established through trial testing by using fifty (50) SS II chemistry students from Model Secondary Co-Educational School in Nsukka Education Zone of Enugu State. Those students were similar to the students that were used for the study in terms of Age, Sex, among others. The reliability of CAT was determined by using Kudder-Richardson's formula 20 (K-R-$_{20}$). The choice of K-R-$_{20}$ was because the instrument used was a multiple choice test items with right and wrong option. Moreover, it is an appropriate method used in determining the internal consistency of items that are scored dichotomously. The internal consistency index obtained for CAT using K-R-$_{20}$ was 0.82. Three (3) regular chemistry teachers in the three sample schools who served as research assistants in the study were exposed to pre-experimental training programme by the researcher for three days. The training session was conducted in Government Technical College (GTC) class room. It was easy by the researcher to bring all the three research assistants together for the training programme since all of them are residing in Enugu Metropolis. It was equally their decision to carry the training together. Two sets of instructional packages (lesson plan) for teaching the unit of chemical equilibrium were prepared by the researcher. The instructional packages were used for both the treatment and control groups. The programme helped in establishing a common instructional standard among the chemistry research assistants. The pre-CAT was administered to the students before the commencement of teaching as well as treatment by the research assistants in the sample schools.

The pre-CAT was used to determine the students' knowledge of the topic and also to determine the comparability of the three groups (experimental and control groups) with respect to their achievement in pre-test scores. The teaching of the topics for the study lasted for two (2) weeks for each school involving three periods of forty (40) minutes per week. The teaching method which was lecture method was the same for both treatment (immediate and delayed feedback) and control group (No feedback) in the three (3) intact classes from the sampled schools used for the study. The treatment and control groups were taught using the same teaching method because the study centered on giving immediate or delayed feedback on the result of chemistry test (pre-test) which was administered to the students. The main treatment for the study was the feedback which the student received on correctness or incorrectness of their responses in the pre-test scores using two treatment procedures (immediate and delayed feedback). The immediate feedback group were exposed or shown the correctness and incorrectness of their responses as reflected in their scores immediately after the pre-test. This was done by first of all, collecting the students' scripts immediately after completion of the test administered, marking and scoring the scripts by the teacher using the marking scheme. The marked scripts (question papers students supplied their answers in) were then returned to the students immediately to look at where they got it right or wrong. The teacher at the same time provided an explanation or feedback as to what was accurate and inaccurate about the answers supplied by students in the pre-test so that students would understand why and how they got it right or wrong. After the explanation by the teacher, the pre-CAT student's question papers with the supplied answers were taken away from the students for recording. The delayed feedback group were exposed to or shown the correctness or incorrectness of their responses as reflected in their scores two (2) weeks after the pre-test (After two (2) weeks of teaching). This was carried out by collecting the students' supplied answered scripts immediately after the completion of the test administered to them for marking and scoring by the teacher using marking scheme. The marked scripts was then returned to the students after completion of two (2) weeks teaching of the students to look at where they got it right or wrong. The teacher at the same time provided an explanation or feedback as to what was correct or incorrect about the answers to students' pre-test so that students would understand why and how they got it right or wrong. After the explanation by the teacher, the pre-CAT question papers containing the supplied answers by the students were taken away by the teacher.

The control group were not exposed to or provided with information about the correctness or incorrectness of their responses or answers as reflected in their pre-test scores. The teacher administered the pre-test to the students and collected the answered scripts at the end of the time allocated for the test for marking and scoring. The marked scripts were not returned to the students and the students were not given any feedback as to the correctness or incorrectness of their answers to the pre-test. After treatment for both treatment groups, the post-test were then administered to the students (the treatment and control groups) after two (2) weeks. The answer scripts were collected from students

after the post-test for marking and proper recording of scores in line with the marking scheme. The pre-CAT and post-CAT were the same set of questions but the questions were reshuffled (i.e. re-numbered) in the post-CAT. The researcher did not teach the students. This was done by their regular classroom teachers of the participating classes but under the supervision of the researcher. The materials for teaching the students were prepared by the researcher. The researcher organized a pre-experimental training program for the chemistry teachers of the intact classes used for the study to ensure common instructional standard among chemistry teachers and to adhere strictly to procedure to ensure uniformity. At the end of the training, the teachers practiced the procedure and applied them as they relate to giving feedback to the students. To solve the problem of inter-class discussion among students, one intact class only was used in each school in each local government. Due to the nature of the administrative set up in the school, there was non-randomization of research subjects since the students had already been organized in classes. Effect of pre-test on post-test: The post-test was conducted three weeks after pre-test and it is expected that this period is long enough not to permit the pre-test to affect the post-test scores. Moreover, the researcher reshuffled/renumbered the items of the post-test before administering the post-test to the students. After administration of the Chemistry Achievement on the students by the Chemistry teacher, the CAT were collected, marked and the scores for both the experimental and control groups were recorded accordingly. The test items in both the pre-test, and post-test were scored one (1) mark each. The maximum mark was forty (40) while the lowest mark was zero (0) Mean and Standard deviation were used to analyze data and provide answers to research questions. Analysis of covariance (ANCOVA) was used to test hypotheses at .05 level of significance. ANCOVA was used to correct the error of initial differences in ability levels among the research subjects. They were calculated using statistical package for social science (SPSS) software. The following decision rule guided the study. Reject the null hypotheses if the *p*-value of the test statistics is less than or equal to 0.05 level of significance set for the study, otherwise fail to reject.

Results

Research Question 1

What are the mean achievement scores of students who received immediate feedback and those that did not receive feedback when taught chemistry.

Table 1: Mean Achievement and Standard Deviation Scores of Students who Received Immediate Feedback and those that did not Receive Feedback when Taught Chemistry

Group	N	Pretest		Posttest		Mean Score
		mean ($\bar{x}$)	SD(σ)	mean ($\bar{x}$)	SD(σ)	Difference
Control(No Feedback)	46	19.01	22.02	52.76	10.66	33.75
Experimental(Immediate feedback)	50	26.62	9.04	74.68	8.02	48.06
Mean Difference	**96**	**7.61**		**21.92**		**14.31**

Table 1 shows the mean achievement scores and standard deviation of students who received immediate feedback and those that did not receive feedback (control) when taught chemistry. The result of the analysis showed that students who did not receive any feedback (control) obtained mean scores of 19.01 and 52.76 respectively in their pretest and posttest with corresponding standard deviations of 22.02 and 10.66. On the other hand, students who received immediate feedback had mean scores of 26.62 and 74.68 respectively in their pretest and posttest with corresponding standard deviations of 9.04 and 8.02. From the result, it showed that learning took place. This is because the two groups achieved higher posttest mean scores than their pretest mean scores. However, the posttest mean achievement scores of the experimental group (immediate feedback) was higher than the posttest mean achievement scores of the control group. Moreover, the standard deviation scores of posttest for students who received immediate feedback was 8.02 while control group is 10.66 indicating that the students individual scores were clustered around the mean with the experimental group(immediate feedback) than control group(No feedback). Hence, it was deduced that students who received immediate feedback achieved higher than those with no feedback.

Research Question 2

What are the mean achievement scores of students who received delayed feedback and those that did not receive feedback when taught chemistry

Table 2: Mean achievement and standard deviation scores of students who received delayed feedback and those that did not receive feedback when taught chemistry

Gender	N	Pretest		Posttest		Mean Score
		mean ($\bar{x}$)	SD(σ)	mean ($\bar{x}$)	SD(σ)	Difference
Control(No Feedback)	46	39.52	9.29	46.60	8.80	7.08
Experimental(Delayed feedback)	48	46.74	11.27	60.21	7.96	13.47
Mean Difference	**94**	**7.22**		**13.61**		**6.39**

Table 2 shows the mean achievement scores and standard deviation of students who received delayed feedback and those that did not receive feedback (control) when taught chemistry. The result of the analysis showed that students who did not receive any feedback (control) obtained mean scores of 39.52 and 46.60 respectively in their pretest and posttest with corresponding standard deviations of 9.29 and 8.80. On the other hand, students who received delayed feedback had mean scores of 46.74 and 60.21 respectively in their pretest and posttest with corresponding standard deviations of 11.27 and 7.96. From the result, it showed that learning took place. This is because the two groups achieved higher posttest mean scores than their pretest mean scores. However, the posttest mean achievement scores of the experimental group (delayed feedback) was higher than the posttest mean achievement scores of the control group. In addition, the standard deviation scores of posttest for students who received delayed feedback was 7.96 while control group is 8.80 indicating that the students individual scores were clustered around the mean with the experimental group(delayed feedback) than control group(No feedback). Hence, it was deduced that students who received delayed feedback achieved higher than those with no feedback.

Research Question 3

What are the mean achievement scores of students who received immediate feedback and those that received delayed feedback when taught chemistry

Table 3: Mean achievement and standard deviation scores of students who received immediate feedback and those that received delayed feedback when taught chemistry

Group	N	Pretest		Posttest		Mean Score Difference
		mean ($\bar{x}$)	SD(σ)	mean ($\bar{x}$) SD(σ)		
Experimental (Delayed Feedback)	50	45.16	12.80	73.63	9.85	28.47
Experimental(Immediate feedback)	48	41.95	9.58	52.61	11.01	10.66
Mean Difference	**98**	**3.21**		**21.02**		**17.81**

Table 3.shows the mean achievement scores and standard deviation of students who received immediate feedback and those who received delayed feedback when taught chemistry. The result of the analysis showed that students who received immediate feedback obtained mean scores of 41.95 and 52.61 respectively in their pretest and posttest with corresponding standard deviations of 11.01 and 9.85. On the other hand, students who received delayed feedback had mean scores of 45.16 and 73.63 respectively in their pretest and posttest with corresponding standard deviations of 12.80 and 9.58. From the result, it showed that learning took place. This is because the two groups

achieve higher posttest mean scores than their pretest mean scores. However, the posttest mean achievement scores of the experimental group (delayed feedback) was higher than the posttest mean achievement scores of experimental group (immediate feedback). In addition, the standard deviation scores of posttest for students who received delayed feedback was 9.58 while those who received immediate feedback was 9.85 indicating that the student's individual scores were clustered around the mean with the experimental group (delayed feedback) than immediate feedback. This is an indication that students who received delayed feedback achieved more than those who received immediate feedback.

Research Question 4

What are the mean achievement scores of male and female students who received immediate feedback and delayed feedback when taught chemical equilibrium?

Table 4: Mean achievement and standard deviation scores of male and female students who received immediate feedback and delayed feedback when taught chemistry

Gender	**N**	**Pretest**		**Posttest**		**Mean Score Difference**
		mean ($\bar{x}$)	**SD(σ)**	**mean ($\bar{x}$)**	**SD(σ)**	
Male (immediate feedback)	28	39.52	9.29	60.60	9.96	21.08
(delayed feedback)	20	42.56	10.11	71.23	7.55	28.67
Female (immediate feedback)	26	46.74	11.27	59.60	10.28	12.86
(delayed feedback)	24	36.74	11.34	47.30	7.86	10.67
Total	**98**					

Table 4.shows the mean achievement scores of male and female students who received immediate feedback and delayed feedback when taught chemistry. The result of the analysis, showed that the posttest mean achievement scores and standard deviation of male students in the immediate feedback were 60.60 and 9.96 respectively, while that of female students were 59.60 and 10.28 respectively. In the delayed feedback,, the mean achievement scores and standard deviation of male students were 71.23 and 7.55 while that of female students were and 47.30 and 7.86 respectively. The analysis showed that male students had higher mean achievement score and smaller standard deviation than their female counterpart. This implies that the mean achievement scores of the male students was homogenous than that of female, and the male students achieved more in the immediate feedback than the female counterpart. While in the delayed feedback going by the mean, also indicates that male achieved more than their female counterpart when taught chemistry.

Hypotheses

Hypothesis 1*:* There is no significant difference between the mean achievement scores of students who received immediate feedback and those that did not receive feedback when taught chemistry.

Table 5: Summary of One-way ANCOVA on the mean rating achievement scores of students who received immediate feedback and those that did not receive feedback when taught chemistry.

Source	Type III Sum of Squares	df	Mean Square	f	Sig.
Corrected Model	.046[a]	1	.046	.036	.850
Intercept(immediate and no feedback)	2015.462	1	2015.462	1557.788	.000
Immediate feedback	.046	1	.046	.036	.000
Error	395.902	94	1.294		
Total	2412.000	96			
Corrected Total	395.948	95			

a. R Squared = .000 (Adjusted R Squared = -.003)

Table 5 shows that F (1, 94) = 0.036 and sig = 0.000. Since the significant value for treatment $p = 0.000 < 0.05$, the test statistic is considered significant. The null hypothesis of significant difference between the mean achievement scores of students who received immediate feedback and those that did not receive feedback when taught chemistry was rejected. This means that the difference in mean achievement scores of students who received immediate feedback and those that did not receive feedback when taught chemistry was statistically significant.

Hypothesis 2*:* There is no significant difference between the mean achievement scores of students who received delayed feedback and those that did not receive feedback when taught chemistry.

Table 6: Summary of One-way ANCOVA on the mean achievement scores of students who received delayed feedback and those that did not receive feedback when taught chemistry.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.374[a]	1	.374	.289	.591
Intercept(delayed and no feedback)	1859.283	1	1859.283	1438.264	.000
Delayed Feedback	.374	1	.374	.289	.026
Error	395.574	94	1.341		
Total	2412.000	96			
Corrected Total	395.948	95			

a. R Squared = .001 (Adjusted R Squared = -.002)

Table 6shows that F (1, 94) = 0.289 and p = 0.026. Since the significant value for method $p = 0.026 < 0.05$, the test statistic is considered to be significant. There was a significant difference between the mean achievement scores of students who received delayed feedback and those that did not receive feedback when taught chemistry was rejected. Thus, treatment was a significant factor as regards students' achievement in teaching chemistry.

Hypothesis 3: There is no significant difference between the mean achievement scores of students who received immediate feedback and those that received delayed feedback when taught chemistry.

Table 7: Summary of One-way ANCOVA on the mean achievement scores of students who received immediate feedback and those that received delayed feedback when taught chemistry.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7042.721[a]	1	7042.721	71.995	.000
Immediate feedback	7142.821[a]	1	7142.821	72.913	.000
Intercept	968444.000	1	968444.000	9900.060	.000
Delayed feedback	7042.727	1	7042.727	71.995	.000
Error	29933.542	96	97.822		
Total	1149259.000	98			
Corrected Total	36976.269	97			

a. R Squared = .190 (Adjusted R Squared = .188)

Table 7 shows that F (1, 96) = 71.995 and $p = 0.000$. Since $p < 0.05$, the study therefore finds the test statistics to be significant. The null hypothesis which states that there is no significant difference between the mean achievement scores of students who received immediate feedback and those that received delayed feedback when taught chemistry was rejected. This indicates that the difference in mean achievement scores of students who received immediate feedback and those that received delayed feedback when taught chemistry was statistically significant for the delayed feedback but it was not significant on the immediate feedback. Hence, it can be concluded that delayed feedback has more achievement impact on the students.

Hypothesis 4*:* There is no significant difference between the mean achievement scores of male and female students who received delayed feedback and those that receive immediate feedback when taught chemistry.

Table 8: Summary of One-way ANCOVA on the mean achievement scores of male and female students who received delayed feedback and those that receive immediate feedback when taught chemistry

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	.486[a]	4	.162	.125	.946	.001
Intercept	1605.584	1	1605.584	1234.247	.000	.802
Male* Delayed Feedback* Immediate Feedback	.401	1	.401	.309	.579	.001
Female* Delayed Feedback* Immediate Feedback	.506	1	.506	.321	.201	.000
Delayed Feedback	.301	1	.351	.333	.432	.005
Immediate Feedback	.009	1	.009	.007	.933	.000
Gender* Delayed Feedback* Immediate Feedback*Achievement	.112	1	.112	.086	.770	.000
Error	395.462	140	1.301			
Total	2412.000	144				
Corrected Total	395.948	143				

a. R Squared = .001 (Adjusted R Squared = -.009)

Table 8 reveals that F (1,140) = 0.086 and p = 0.770 for gender, delayed feedback, and immediate feedback. Since p> 0.05, the study finds not to be significant. The study therefore, concludes that there was no difference between the mean achievement scores of male and female students who received delayed feedback and those that receive immediate feedback when taught chemistry. The null hypothesis of no significant difference between the mean achievement scores of male and female students who received delayed feedback and those that receive immediate feedback when taught chemistry was not rejected. Hence, gender wasn't a factor

Discussion of the Findings

Findings from the result of data analysis are discussed as follows;

Effect of immediate feedback on students' mean achievement in chemistry

The result of the analysis has shown that immediate feedback of result is effective in enhancing students' achievement in chemistry. The result indicated that students who received immediate feedback of result achieved better in chemistry more than those students with no feedback. The finding of the study revealed that students who received immediate feedback had higher mean achievement scores that those without feedback. This showed that students who received immediate feedback achieved better in chemistry than those students that did not receive any feedback (control group). This finding of the

study agrees with the finding of Ajogbeje (2012), and Lemley (2017) who posited that students who are exposed to immediate feedback of result achieve better than those without feedback. This is stemmed from the fact that when students are provided information regarding the correctness or incorrectness of their responses immediately after a formative test, it enhances learning as behaviour is observable and still fresh in memory and thus promote achievement of learned information. Moreover, the relative effectiveness of immediate feedback over no feedback in enhancing students achievement could be attributed to the fact that immediate feedback influences the readiness, interest, motivation and attention of students in the class as well as facilitates the existence of interaction between the teachers and the students, this will make them achieve better than those without feedback as indicated in the higher achievement scores of students who received immediate feedback over students with no feedback.

Effect of delayed feedback on students' mean achievement in chemistry.

The finding of the study revealed that delayed feedback of result improve students achievement in chemistry. The result showed that students who received delayed feedback achieve better than those students with no feedback. The finding of the study showed that students who received delayed feedback had higher mean achievement scores than those without feedback. This showed that students in the experimental group who received delayed feedback achieved better in chemistry than those students who did not receive any feedback (control group). The finding of the study agrees with the finding of Reyes (2013), which showed that students achieved better when they are exposed to delayed feedback of the result than no feedback. This could stem from the fact that when a little time is taken to provide information regarding the correctness or incorrectness of the response to students after a test, it encourages the students to anticipate the answer which may increase their level of attention to it when they eventually receive the feedback, thereby making the students achieve higher as indicated in the higher achievement scores of students who received delayed feedback in chemistry over students with no feedback.

Effect of immediate and delayed feedback on student's mean achievement in chemistry:

The result of the data analysis has shown that feedback, both immediate and delayed feedback of the result are effective in enhancing students achievement and retention in chemistry. This finding agrees with the finding of Sinha(2012) who found out that feedback whether immediate or delayed has a significant effect on students achievement. Further analysis of the result revealed that immediate and delayed feedbacks are more effective in enhancing students' achievement in chemistry than no feedback. Students who receive immediate and delayed feedback of their result had higher academic achievement than their counterparts that didn't receive any feedback.

Furthermore, the finding of the study revealed that students who received delayed feedback had higher mean achievement scores that the students who received immediate feedback. This means that delayed feedback is more effective than immediate feedback in enhancing students' achievement in chemistry. This finding is in agreement with the finding of Ezekwesili and Ngonebu (2015) who found out that delayed feedback is more effective in enhancing student's achievement than immediate feedback. The effectiveness of delayed feedback over immediate feedback could stem from the fact that students tend to correct their wrong responses on their own during the period of delay thereby having a better insight into their errors and this enable them to perform better. In order words, it tends to encourage the students to anticipate the answer which may increase their level of attention to it when they finally receive the feedback. This finding disagrees with the finding of Ajogbeje(2012), which indicated that students who received immediate feedback achieved higher than with delayed feedback. Conclusively, the finding revealed that students who are exposed to delayed feedback of their result achieve and retain better in chemistry.

Influence of gender on students mean achievement in chemistry.

The finding of the study on gender from table 4 showed that male and female students achieve higher on their posttest scores for both treatment groups (immediate and delayed feedback) but the male students achieve higher than their female counterparts. However, the hypothesis testing revealed that this difference in the mean achievement scores for both male and female students exposed to immediate and delayed feedback is not significant. The finding of the study revealed that there is no significant difference in the mean achievement scores of male and female students when they received immediate and delayed feedback in chemistry. In order words, gender has no effect on the mean achievement of students in chemistry when they receive immediate and delayed feedback of the result. This finding is in agreement with the finding of Omeke (2012) which showed that gender has no effect on students' achievement in chemistry. The finding equally collaborated with the finding of Ogbonna (2010), that there is no significant difference in the achievement of male and female students in chemistry. In order words, they maintained that gender has no significant influence on the academic achievement of students in chemistry. Nevertheless, the finding of the study disagrees with the finding of Ameh (2014) and Apper (2016) who found significant difference in the achievement of male and female student in chemistry. They maintained that gender has significant influence on the academic achievement in chemistry. Meanwhile, the effectiveness of both feedbacks (immediate and delayed) on both male and female students could be attributed to the fact that students were given equal opportunity to receive the feedbacks irrespective of their gender. The fact that the difference in achievement of both male and female students in chemistry is not significant means that the feedback employed whether immediate and delayed are equally effective for male as well as female students in enhancing academic achievement. In order words, gender has no significant influence

on the academic achievement of students when effective assessment procedure such as immediate and delayed feedback are employed by the teacher during teaching and learning.

Conclusion

From the findings of this study it is concluded that immediate feedback and delayed feedback used in this study had significant effect on students' academic achievement in the topic taught. This means that these assessment procedures were effective in improving students' achievement in chemistry. Meanwhile, the researcher further found out that students that received immediate and delayed feedback of their results were more effective that the students with no feedback in enhancing students' achievement in chemistry. These assessment procedures (immediate and delayed feedback) have been proven to be more effective in facilitating students' achievement in chemistry more that no feedback. Moreover, the study also found that students exposed to delayed feedback of result enhance students' achievement in chemistry more than those exposed to immediate feedback of result. The study also found out that there was no significant difference in the academic achievement of male and female students in chemical equilibrium in chemistry. Based on the findings of this study, it has be established that when teachers give delayed feedback of result as a form of assessment or evaluation procedure after a given test during teaching and learning in chemistry, students' achievement would greatly improved and this improvement will not be significantly influence by gender.

Educational Implications of the Study

The finding of this study has some obvious educational implication for the chemistry teachers, students, chemistry curriculum planners and ministry of Education.

The study has provided an empirical evidence to support the efficacy of giving delayed feedback of students' result of test or tasks in facilitating students' achievement in SSII chemistry. The researcher therefore advocates the need for the chemistry teachers to employ the use of delayed feedback assessment procedure in order to equip them with the knowledge of knowing the strength and weaknesses of the students undergoing instruction and give appropriate remedial teaching for improved academic achievement.. In order words, it will assist the teachers to guide, direct and monitor student learning and progress towards improved performance. The finding of the study further revealed that there was no significant interaction effect of immediate feedback, delayed feedback and gender on students' achievement in chemistry. This means that students whether male or female achieve higher when they are provided with the feedback of their result especially delayed feedback of their results.

The findings of the study also have implication for the chemistry students. When the result of their assessment is made known to them, it will make the students concerned to begin to have a better understanding of their capabilities and develop capacity to

monitor, evaluate and regulate their own learning. In order words, the finding of the study will motivate the students and provide information that they can use to improve their learning which leads to improved academic achievement.

The efficiency of employing feedback especially delayed feedback of result as an assessment procedure has been proven as indicated by the findings of the study. It therefore becomes necessary that chemistry curriculum planners should adopt such approach and incorporate the use of feedback assessment procedure during teaching and learning process in schools.

To the Ministry of Education, the findings of the study implies that workshops, seminars and conferences should be organized from time to time for the chemistry seminars and conferences should be organized from time to time for the chemistry teachers in order to train and sensitize them on the need to incorporate feedback especially delayed feedback assessment procedure during teaching and learning.

Recommendations

In view of the afore-mentioned educational implication of the findings of this study, the research hereby recommends as follows:

1. Chemistry teachers should ensure that students are given feedback especially delayed feedback of their result during teaching and learning by providing an explanation and examples as to what is accurate and inaccurate about their work. This will make the students concern to begin to have a better understanding of their capabilities and develop capacity to monitor and evaluate their own learning leading to improve academic achievement in chemistry.
2. Feedback (especially delayed feedback) assessment procedure should be included in the chemistry curriculum of teachers training Institutions, in order to popularize their use among the teacher trainees so as to bring about more effective achievement in chemistry in the secondary schools. This is because, the finding of the study have proven that delayed feedback are more effective in enhancing students achievement in chemistry than immediate feedback and no feedback.
3. Chemistry teachers should be encouraged to attend regular workshops and seminars to acquaint themselves with those requisite skills associated with delayed feedback assessment procedure. Such workshops should be organized by government and professional bodies such as STAN to educate and sensitize them in the effectiveness of using the procedure in enhancing students' achievement.
4. Government agencies/bodies, professional association and curriculum planners should ensure that curriculum implementers put into practice the use of delayed feedback assessment procedure in teaching and learning.

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